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ABSTRACT

An invitation to participate in this panel discussion was sent to official representatives of organizations which had an expressed interest in information networks. Since some of the represented international bodies had started preliminary planning for network communication, the discussion was centered around systems design concepts. However, as some groups were still at a policy-making stage focus was also placed on goal-setting through formalized methods known as "the systems analysis approach." The panelists' comments on crude goal-setting and ranked priorities for systems design ccncepts are included as Appendices 3-7. The theme paper: "Systems Design Concepts for Automated International Informaticn Networks," by K. Samuelson was circulated to all the panelists, this served to bring terminology consistency into the discussion. (NH)

FID/TM: THEORY OF MACHINE TECHNIQUES AND SYSTEMS — SECRETARIAT

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AUTOMATED INTERNATIONAL INFORMATION NETWORKS
Systems Design Concepts, Goal-Setting and Priorities

FID/TM Panel at the ASIS Meeting
in San Francisco, 2 October, 1969
by

KJELL SAMUELSON

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FOREWORD

The area of automated international information networks since 1966 has been the long-range concern of FID/TM. During the FID/IFIP conference in Rome in 1967 the committee decided to concentrate its efforts specifically on "the systems analysis approach" in goal-setting and policy-planning towards international information transfer and network communication.

Through international joint efforts the FID/TM scope of interests has been substantiated in the following technical report which is the result of multi-organizational contributions. In response to an invitation from ASIS (American Society for Information Science) it was possible for FID/TM to sponsor a panel in context to the 32nd annual ASIS meeting in San Francisco, California on October 2, 1969. The theme for the panel discussion was "Automated International Information Networks - Systems Design Concepts".

FID/TM whishes to thank the ASIS hosts, the participating organizations, the panelists, the conference audience and all others who have contributed in making the following work presentation come true.

K. Samuelson
Chairman of FID/TM
Federation Internationale de Documentation
Theory of Machine techniques and systems

AUTOMATED INTERNATIONAL INFORMATION NETWORKS

Participants:

Name, Organization:	Representing:
Scott Adams National Academy of Sciences, Washington, D.C., USA	UNISIST (UNESCO/ICSU)
Gerald X. Amey Department of National Defence, Ottawa, Canada	Canada (FID/TM-member)
Harold Borko University of California, Los Angeles, USA	FID/TM (FID/TM-member)
Herbert Koller LEASCO, Systems & Research Corp. Bethesda, Maryland, USA	USA (FID/TM-member)
Milos Komurka International Atomic Energy Agency Vienna, Austria	INIS
Ethel Marden National Bureau of Standards, ~~Washington, D.C.~~ Gaithersburg, Maryland, USA	Audience
Kjell Samuelson Inst. Information Processing - ADP, Royal Institute of Technology, Stockholm, Sweden	Chairman, moderator
Björn Tell Royal Institute of Technology Library Stockholm, Sweden	OECD (FID/TM-member)
Brian Vickery ASLIB London, U.K.	U.K. (substituting FID/TM-member Michael Lynch, University of Sheffield, U.K.)

Editor's Note

The editing of this technical report was carried out mainly with regard to "debugging" from non-message phrases, stuttering etc. on the tape recording. All comments have been left unedited which means that slight redundancy, minor errors and misinterpretations have been allowed in order not to let perfectionism prevent an early report release.

INTRODUCTION AND METHODOLOGY

When FID/TM took on the sponsorship of a panel discussion on "Automated International Information Networks" the prevailing conditions were as follows.

The conference topic certainly is a matter of global interest to a multitude of organizational bodies. Therefore, an invitation to participate was sent to official representatives of organizations which had recently announced an interest in information networks. The list of participants is outlined in the preface and there has, no doubt, been an overwhelming reception of the initiative.

Since a few of the represented international bodies had already started preliminary planning for network communication, it was estimated that the discussion should be centered around systems design concepts. On the other hand, as some groups were still at a policy-making stage it also proved appropriate to focus on goal-setting through formalized methods known as "the systems analysis approach".

For methodology reasons a theme paper (Ref. 1 and Appendix 1, 2) was circulated to all the panelists and they were asked to submit to the chairman comments on crude goal-setting and ranked priorities for systems design concepts (Appendix 3-7). The theme paper (Ref. 1) also served the purpose of bringing terminology consistency into the discussion. Thus, the panelists were given formalized cause/effect relationships between network systems design concepts and were also exposed to crude precedence analysis. In this way it is possible to simulate manually how a step-by-step design and development might turn out, just like "pulling strings and watching the attached events". As can be seen in the comments of the panel and in the Appendices it proved quite feasible to follow formalized procedures for constructive thinking and network layout.

When representatives from as many as eight different organizational bodies are meeting to express formalized multigoals, several different situations can be anticipated. A few parties might have identical ultimate desires while their modes of working towards goal achievement could be completely different. It is also possible that organizational bodies having conflicting higher goals might still follow quite similar routes of task implementation based on operational goals. Most likely all bodies have at least an overlap of a few objectives as well as several design tasks and performance characteristics. Even so, the pace, magnitude, order and time schedule for automated information-network implementation might turn out to be different due to the varying levels of ambition. There also exists a documented resistence against the declaration of goals through formalized procedures (Ref. 2, 3). Policy-makers are reluctant to express somewhat vague general directives which can be interpreted in the way that is most convenient at a particular, future occasion.

Besides, it has turned out in previous debates that indeed very few policy-planners and decision-makers are at all used to apply systems analysis methods to initial goal-setting. Such circumstances are easy to realize if one takes into consideration that this methodology science (Ref. 4) is very new and interdisciplinary systems analysts are often quite young experts whose capacities have not yet been sufficiently utilized for consultation at appropriate policy-making levels. Several examples of what has been said, were confirmed during the panel session and it is hoped that this will serve as a stimulus towards formalization of goal-setting regardless whether the problem be labelled socio-economic, psychological, political, technical, information explosion, communication barrier or what have you.

In agreement with long-range scope-of-interests, the FID/TM will in above respects serve the purpose of exploring similarities and discrepancies with respect to goals and systems design.

A survey of the actual situation of "World-Wide Information Networks" as well as "International Information Transfer and Network Communication" will be reviewed in depth during 1970-71 in extended studies by the editor. Therefore, this editor would like to take the opportunity to encourage all readers to forward related reports, reprints, papers and other relevant material to the FID/TM secretariat.

System Design Concepts for Automated International Information Networks - Panel Discussion

K. Samuelson:

Starting with Dr. Adams I can say that I was very pleased to receive some of the comments he made (Appendix 3). He emphasized the fact that the field of information networks is a problem of communication and it is very much concerned with socio-economic and political requirements. Now, those expressions still call for further concept definitions. Dr. Adams also emphasized standardization and interconnectibility of system as being important and I could rephrase that terminology to compatibility and convertibility between systems as well. He has also touched upon the subject of the eventual existence of superdisciplinary fields and centralized national efforts. I would say the first is an expression of functional borders and the second concept is a matter of regional borders. Finally Dr. Adams ends with the statement that it is important to conceptualize in order to motivate and I say that is very clear for the formalization of goal concepts. I will first give the microphone to Dr. Adams for about three minutes comments on this point.

S. Adams:

Thank you Kjell. Our chairman has circulated to all members of the panel a very thoughtful document which gave a matrix of alternative or multiple priorities in systems design (Appendix 2, Ref. 1). At the first part of this document there was an area of pre-existent characteristics or parameters of a system. I choose to confine all of my comments from the point of view of UNISIST to these, what Dr. Samuelson has termed the pre-existent of givens prior to the actual analysis of the individual technical parameters of any international system. I did this because from the UNISIST point of view I am thoroughly convinced that the systems engineering is a problem of social engineering, if you will, social and political engineering. I think that UNISIST is more properly concerned with the

creation of favourable political climates among countries to encourage a multiplicity of international systems designs, using different alternative path ways. That is itself to be approached or to be understood from the point of view of systems design. Now,maybe I might expand on that a little bit. UNISIST is a joint effort on the part of both ICSU i.e. the International Council of Scientific Unions and UNESCO and it has been labelled as a feasibility study, to study the feasibility of a world science information system. This is in fact a little something of a misnomer. What it is more concerned with is to guide the evolution of existing systems and of developing systems in all areas of the natural sciences and by extention to the technologies and to the social sciences. It is not a system in itself, and it is not a network in itself. It is a program which as I say can provide hospitality to multiple international developments. It will keep the creations of international systems whether they be at the level of scientific disciplins themselves as for ex. international system in chemistry, I see Jim Wood in front of me here, and medicin or in nuclear energy or in physics and there are international systems on the development in each of these areas; or whether it is concerned with the interconnectibility, if you will, of national systems e.g. the Czechoslovakian Centralized Scientific Documentation Institute as it relates to the new COMECON International Institute for Scientific and Technical Information recently established in Moscow and the like at the national political level; or interconnections between the sciences, that is between a chemical information system which is international and a group of nationally oriented systems which are concerned with the exploation of information which is in the discipline based system. I think this is perhaps enough to say by way of introduction, but I want to make a simple point that UNISIST itself is not a system, nor is it a network, it is essentially a long range program to encourage the development of interconnectibility among and between the existing systems in the sciences and under national sponsorship throughout the world. For this reason I am primarily concerned with the socio-political parameters, that is with the matrix under which systems analysis and development can occur.

K. Samuelson:

Thank you Dr. Adams. Next, I would like to invite Dr. Komurka from INIS to make his comments. Dr. Komurka has submitted seven different network concepts which have high priorities (Appendix 3). They are not necessarily representing ranked orders between themselves, but anyhow, they have high priority. These concepts are:

- Awareness of existing information services
- Minimization of central costs
- Universal usefulness of the data base
- Avoidance of linguistic problems
- Compatibility within systems and subject fields, i.e. the software part
- Compatibility with hardware
- Availability of full texts.

The first concept "awareness", I would say, could be helped by the existence of a referral switch or directory between data bases, in the terminology which we have been using. Three of the other topics; "linguistic" and the two "compatibility" problems, belong to the concept of compatibility and convertibility "Universal usefulness" I would say corresponds to coverage and span-of-contents. I would prefer not to dwell on costs and will explain why later on. I will give the microphone to Dr. Komurka, if there are some more comments you would like to make on this.

M. Komurka:

First I would like to stress that the international nuclear information system is not a system which was developed by the International Atomic Energy Agency, but it is a system which was developed by its member states. When we started to think about such a system we had to think about the fact that there are, I don't know, about 100 member states which sure will cooperate in this system and therefore the idea or the main concept, which was taken and which perhaps is not clearly mentioned in my comments, was the decentralized input preparation.

The next concept, which perhaps also is not clear from my comments, was the centralized processing of the input and centralized subject control. Another main concept was the decentralized output use and I think from these three main concepts could all others be derived. Of course because this is a real international system we were very careful about the linguistic problems, about the consistency in subject control and of course, even if my colleagues do not yet want to speak about it, also about the costs, I mean the central costs within the gency.

K. Samuelson:

Thank you Dr. Komurka. Maybe now is the time when I should explain why we might rather talk about costs after Dr. Borko has arrived here to join the panel. Very often it happens when you start a round-table-discussion on the policy making, that you immediately begin with costs; how much would this participant in the network be willing to pay? The discussion goes on and on and all kinds of concepts are discussed except systems design concepts. After the decision making has been completed and some budget has been allocated, the systems analysts are brought into the field mainly as technicians and asked: Well, get somesystem started or do something about it. Systems analysts should rather be brought in at proper time already in the beginning to help the various organisational bodies with goal definitions, to establish and to formalize their ultimate desires and their operational goals which are decomposed into various priorities and subgoals. After that you can start talking about levels of ambition and how much are you willing to pay to achieve this or that level to meet your aspiration. You might be surprised to learn that you will get several of these concepts or design parameters implemented at just about the same low cost. You might then only add one more parameter which you did not expect originally and that single adjustment could double or triple the cost. That is one of the reasons why I say, let us talk about costs after we have been talking about the goal definitions and some of the performance tasks, and eventually design tasks. Now, I would like to give

the microphone to Dr. Koller. Since we have both been victims of the mail we have not been able to keep a correspondence on this topic, but I am sure that Dr. Koller has collected some valuable viewpoints from the U.S. for this particular session.

H. Koller:

All the factors that were displayed in the matrix that was shown on the board before are certainly relevant to the design of international networks. I would like to point out that there are great many activities going on in the international network field where a great deal of the activities are going to result in systems that are automated within individual countries, but the communication of information will not be automated for a long time, from my view anyhow, in terms of for example satellite communication from one corner of the world to the other. The problems, as I see, in designing international systems fall on two sides, one is the development of the data bases of the information that people want to exchange, the other is the design of the software and hardware communications equipment that will make this change possible. Both of these are long range problems. I think that in order to develop in a very practical way the communication and hardware and software that will really turn out to make all the systems economically practicable, we have lots of years of work ahead of us. By the same token in order to develop the data bases to an adequate size (coverage) we have years of work ahead of us. So, I view the efforts particularly in the chemical area is very significant. The Chemical Abstract Services, you know, has been developing computer data bases and has now very recently concluded agreements with the Central Chemical Organizations in Great Britain and more recently in Germany which will involve input of material to the data base, exchange of information and distribution of information within each of the individual countries. In addition within the United States the Chemical Society has been fostering a series of regional chemical information centers. They now have established them at Georgia, University of Pittsburg, and IITRI in Chicago. At the same time they are organizing a group within continental Europe of organizations which will be sponsoring information centers

there, and we can foresee that this will develop in other parts of the world to the same sponsorship. Now, there are a number of other such developments within the field of patent documentation. Very shortly our information will be coming to the public attention about an international patent information network. Here the basic design of the system was created several years back by the one agency which acts as a secretariat for treaties in the patent trade mark and copyright field. However, the actual implementation of the design, the setting up with the files, the exchange of information is all being done by private industry. Therefore we have a different approach to handling the cost side of international networks. I was going to come into about the international exchange of highway safety data, but Mr. Paulson, who is in the audience here agreed with me, I think, I pointed out to him that there is a great deal of international motor traffic for example between the United States and Canada on the one hand and the United States and Mexico on the other hand, but if you have been reading the papers you know that the United States and Mexico traffic has been rather cut off recently.

K. Samuelson:

Thank you Dr. Koller.

I would like to return to the scope of this panel and review the original idea. We are concerned mainly with automated international information networks. The term networks has been misused, I should say, in many respects, since as soon as you start sending any pack of documents on a regular bases between a few information centers and users you claim to have initiated a few links of a network. It can still be true that it is a network but it is definitely not an automated network. Mainly the tendency is to start growing networks from operational functions, i.e. whatever exists you start by communicating and exchanging services and information. Anyone who has been involved in engineering design would agree on the fact that you don't start building a machine or a car from spare parts which you have been working on separately into details and then later try to put them together. Most

often you find it will not work as an entity. In order to start a design of global networks you would have to be prepared from the beginning to constantly remodel and modify what you eventually have and in a few cases is it a matter of overlapping services. I would not say that overlapping is a bad word. It has been misused and very often formalized as the importance of avoiding overlap. I consider overlap and redundancy for several years to come to be a contribution to "fall-back" possibilities for service. We have seen during this conference and will probably see for a number of years that ultimate procedures have not been outlined for how we are going to treat information.

I will now give the word to Dr. Tell, who appears on this panel as representative of OECD. Dr. Tell has put among the high priority rank concepts, referral switches just like Dr. Komurka did, and he has likewise emphasized availability and coverage, which also is in agreement with Dr. Komurka's conception. I might ask whether you have been working on the same project together before, or how you independently arrived at identical ideas. I believe that Dr. Tell has been involved in the early INIS definitions. Dr. Tell also emphasizes the necessity of satisfactory response time and timeliness. Of course, those expressions indirectly are linked to urgency for information which depends on decision criticality. After he has made a few comments I would like to ask him some more questions. First, however, Dr. Tell might want to further develop his ideas.

B. Tell:

When you say OECD I don't know if all Americans know what it is about and I should like to refer to, that in the new Volume 4 of Annual Review of Information Science and Technology there is a chapter now introduced about the International Transfer of Information. There are also some paragraphs about OECD. I think generally from an American standpoint you refer to OECD as "Old Europe's Counterpart to Disneyland" or something like that. But it is more to it than that, so I think as the

U.S., Japan, Canada and of course the old European countries are members that it can develop something more. OECD has a sort of different approach to the problem of a systems network than the other international organizations I would say, if you might ask, "why here is an other international organization mixing into this field and what is the use of this?". OECD's approach is not to set up any system, it is not to develop any network. OECD's approach is to develop a policy for governments how they shall react nationally and internationally to developing things in this field. Therefore, at the science ministers' meeting about three years ago it was decided that OECD should especially study the compatibility of systems and already when this was said it was discovered that compatibility is not the essential problem, there are other problems. Why I put coverage first on the list of priorities is because I think that from a national government point of view it is necessary that you can assure a good coverage with regard to what you are spending on research. Up till now everybody in OECD has spoken about the essential reasons for national government to encourage scientific and technical research and lately they have started to think that it would also be nice to encourage scientific and technical information. Then I think just during this year another idea has occured and this is that perhaps OECD has tried too long to emphasize economic growth for economic's growth's own sake. Now they are starting to realize some other problems. You have students ~~on rest~~ unrest, air pollution, environmental side effects and everything and then they start to realize that you need more information. You need information for policy making as well as you need a policy for information. So, therefore I think coverage and availability in international network development will be of the primary concern to the national governments and every possibility to make this network more efficient with regard to coverage and availability will be welcome. The plans at present are to try to investigate how the national systems, which as Mr. Koller said, some are international, could develop in a more consistant way and therefore we have to find out more about how the different

systems operate. Just last week it was decided that a questionaire should go out to the existing systems and this will be another of those many long lists of questionaires you have to answer. However, we think it will be useful, because from the answers it will be possible for anyone who intends to run an automated system, to try to find out which system is most similar to what he himself is trying to set up or which system could easily be converted or reformated to anyone's own system. So this is one thing that OECD has undertaken. They have also undertaken the task of trying to find out from a more content point of view what are in the different automated systems, and there the United Nations Economic Commission from Europe is active.
It is funny also that in an Economic Commission for Europe you might think there are just the European countries, but also the Soviet Union and United States are members in the United Nations Economic Commission for Europe. They are collaborating in a study to find out about the existing systems.
I think that is all for the moment.

K. Samuelson

Thank you Dr. Tell. According to the presentation it is appearant, from the OECD point of view, that you still keep designing from the operational side. This makes me even more convinced about the fact, that you have to use systems analysis at a policy planning level and describe what might happen if you continue along the same route for an amount of years. In other words you continue sponsoring regional, national or local operational activities and then in the long run try to interconnect them. One should instead rather give the various operational bodies at least a framework of a hypothetical system, theoretical analysis or a system model. Such an approach indicates what a working model would look like and the way it would function, so at least everybody could have it as an operational goal model. I will return to Dr. Tell with two more questions. You have emphasized precision and recall as high ranked priorities. In this context I should quote what Dr. Lynch has said (Appendix 7) so if Dr. Vickery in his comment would like to extend that statement a little

bit I will be very pleased. Dr. Lynch has put recall and precision on a medium priority level and says: "The user is likely to be tolerant of precision/recall considerations and indeed is mostly unaware of the latter", the latter I presume meaning recall.

After we have heard Dr. Tell's comments I would like to give the microphone to Dr. Vickery.

B. Tell:

Well, first of all I should like to comment what you said that OECD's approach is from the operational point of view. This is not true anymore, but it is true that it has been so for a long time. The very last day on this last year the secretary general called a high level group which met, I think around the 2nd of January. The task of that group is just to formalize a sort of overall policy to which a different system or network could adher, but how do you define this from a policy point of view when they don't know how a network really works or should be working from the operational point of view. This is a very difficult question, because you have to know what you are doing to set a policy. You cannot make this before you know what you are doing. You have to have a policy on how to do things but you must know how the things should be done. So, it is very difficult to formulate a policy in this field, especially on the national level, because governments are not aware of this situation in the information field. They are aware of the fact that scientists need some sort of information and they are aware that Indonesia or certain technicians might need some information, but they are not aware that the policy makers need another kind of information so that the world can become different from what it is today. The second point, you said that I wanted to have a higher recall. Of course this is from an economic point of view and as you said, we are not going to discuss cost factors so I think I will avoid this topic.

K. Samuelson

Thank you Dr. Tell. I think you emphasized exactly what we should keep in mind. Before I give the microphone to Dr. Vickery

I would assume the viewpoint of a "user to be" of a system like this. I would say that it very often depends on the decision situation which I am facing at the moment, whether I should settle for low precision and medium recall or whether I actually require high precision and low recall. Furthermore, the length of time I would be prepared to spend on waiting for the information and the price that I would pay for receiving the service would differ from one time to another. As a matter of fact I would prefer to be served and have a fall-back from different kinds of information service At one occasion I could possibly just settle for a short title search while another time I would want to see the abstract and again a third time I would like to see the first page or the full document. Thus, I think we are facing a multivariate design task which has to do very much with the costs and pricing policy-setting: What kind of service? What kind of performance qualities?

B. Vickery:

As Dr. Samuelson has explained I have come in as a substitute at the last minute without the benefit of the correspondence that the other panelists have been able to take part in. So I have some notes from Dr. Lynch and what you will get is my comments on Dr. Lynch's notes comments on Dr. Samuelson's paper. Thinking of an international information network as a system we are trying to look for what sort of criteria we might use and deciding how to design it. We can think of what is the use of it, what is its effectiveness, what does the manager think of it, what is tis efficiency, its cost, what does society think of it, what is its value anyway. Dr. Lynch has mainly concentrated on the point of view of the user and he has tried to suggest, which criteria the user would rank of most importance in trying to asses a system and therefore in providing the bases on which we should design the system. Naturally the user is most interested in performance and Dr. Lynch makes the point that the ultimate user is not usually the "bloke", who has to pay the money, that is the management or the nation or whoever is in fact funding the

system. Sooner or later of course money does come back to the user in form of taxes, but he is not really quite aware of this. So, the costs are very important from the national point of view. The user is more interested in performance. Some of the aspects that Dr. Lynch mentions is most important from this point of view. First of all, the reliability of the system. Once you have got an automated system it should not break down too often because this causes frustration and very likely eventually falling away from use of the system. If it does break down he emphasizes a fall-back, that is some other systems on which you can fall back and get the information even if your main system is not in action and coupled with this of course the maintenance of the main system is that it breaks down as little as possible. Fall-back may bring in fact this referral-switch to which references has been made so that the user can very readily be referred to an alternative system or alternative source of information if the main system is not in action. So this is one aspect, the reliability and all that goes with it that Dr. Lynch emphasizes. He gives it only medium importance whether a system is centralized or decentralized; this from the point of view whether you are actually tapping one central computer or a regional computer or whatever. This may well be true, but he couples this that the accessibility of the system, the terminal you actually use is of very high importance. The fact that you should be able to make contact with this system very readily from wherever the user happens locally to be. This is a very important charactaristic and I think our all experience as users bears this out that they will not walk across the street to get information unless they are forced to. Dr. Lynch puts his only medium importance, availability, which as I understand it in Dr. Samuelson's paper means the availability of the ultimate information to which the system gives a reference. The availability of the documents shall we say is of only medium importance. This myself I would to some extent doubt, and the lesson I would draw from it is that a design of an automated system must be seen only as a part of a whole information system and that design considerations should be seen in the wider context, not only of reference retrieval, but also document

retrieval, referral and everything else that goes to make up the whole complex information system that we have. Finally, on time factors he puts as a very high importance, response time. This I take it is the time that a system takes to answer when you knock, the time that the computer takes to respond when you press a key or the time that the library assistant takes to come forward to say "Can I help you?". On the other hand he gives very low importance to what he calls priorities and timeliness and he comments that priorities queueing is ranked low. The user will be content to wait for hours or days for access to a terminal, although once he has used it he will expect rapid response. I will doubt this. He also ranked timeliness low and this I take means the degree to which the system is up-to-date in its contents and delivery of material to you. Because, he says, users have also learned to live with this problem, they are used to everything being months out-of-date. Well, I would think that they may be used to it, but they are certainly not happy about it. Well, those are some of the comments that Dr. Lynch has made about the important factors in trying to size up how we should design our automated systems of the future.

K. Samuelson:

Thank you Dr. Vickery. I was very pleased to hear that you and Dr. Lynch do not agree on all points, which merely shows how difficult goal-setting for this field is. In other words, it is difficult to arrive at a concept definition, or even if the definitions are there, to agree on priorities and design concepts. This stresses the fact that the work which the FID/TM committee has undertaken should not be in vain and that there is more work to be done. About availability and accessibility I should say that those terms are used differently in the litterature and sometimes refer to whether you can reach the source of information. In other reports those concepts have been described as a probability function of down-time that you would have to accept for an existant system before it is back in operation. We are hoping for the next year within the FID/TM committee to present some definitions of these concepts as they have been described in the literature. I hope we shall be

able to present a report of what we can gather in terms of the various definitions, although there exists an international information problem internally even in our own case. It is difficult to get the source material and related reports and it is a communication problem for FID/TM. Now, finally I would like to give the word to Dr. Amey before we start the second questioning round. Dr. Amey has emphasized a few more system concepts, which I will just as a summary mention: There is the importance of a continuous evaluation of systems and I agree it is very important that we have an iterated reappraisal even when a system is working. In this way it is essential that there exist several operational systems working in parallel though we might try to have them interconnected. We would continously have to evaluate these services in order to know in which ways to modify one sub-system or another. Dr. Amey also has mentioned one of the priorities specifically which could be important to develop finally. A total system with full redundancy could of course provide for fall-back possibilities but it would be connected with extreme costs. He also stresses that most organizations working in this area are not aware of the fact that the complex is infinitely more complex than you would imagine. I could quote some theoretical work on imperceivable systems (Ref. 6,) or maybe we should call them unsurveyable systems. In fact there exist methods to cope with these systems, by breaking them down into subsystems and then having those further decomposed into procedures. So, there are ways to handle this problem, which should still be brought to general attention at an early policy planning stage. Dr. Amey has also emphasized the value of information in relation to research, which is exactly in agreement with my former comments on the users' needs and his various decision situations. I will not go into details on the budget parts at this time. Dr. Amey is also aware of the fact that there will be an overlap for an amount of years which still is to the best for all of us. There exist legal problems, and those problems would fall into what we have formalized as privacy, integrity, security. Those are extremely complex subproblems which have to be solved and that of course has to be done at appropriate policy planning levels.

But such concepts should be treated as system design parameters and anyone who has been working with data bases will know that even within moderate and small size cooperations there are tremendous problems with log-in and access-keys to keep the various departments separated in terms of the information and controlled access. You can imagine what that will lead to in an international environment, something which we have not been aware of, but which will come along when you start operating automated international networks. I will give the microphone to Dr. Amey to dwell on these concepts.

G.X. Amey:

What I would like to point out is that Dr. Samuelson's concept of system analysis is a little different from mine and I feel that the person is very much involved in the system. In fact nowadays the hardware and software aspects of systems are comparatively trivial and the real problem is in selling a system to people and getting them to use it. In fact even finding the money appears to me to become quite simple these days and very often people for prestige reasons will be very happy to have a computerized system, but when it comes to modifying their organization to make proper use of it they are not willing to make the changes that are necessary. This is particularly the case of course in dealing with nations. Once again, in considering the total system's problem if one is to have an international network one has to get the various countries to agree to standardize on certain items and then within ones own country it is essential that one reaches a level of agreement. In fact this has been proved to be the biggest stumbling block I think here in the U.S. since the first COSATI report. There it was suggested that there should be a capping agency that would have this responsibility, but since this seem to imply that many other agencies would be second class citizens this idea I don't think has been bought. So, the essential requirement before you can begin to make an international system is first of all to form a national system presumedly by cooperation of the major elements in the system. The people in the over-all system should not feel that they have been developing their own systems for years and should

not feel threatened by a bigger system which threatens to overwhelm them leaving no part for the former elements of the system. This is a special problem if there are also commercial sources of information. Therefore I feel that the major thing in forming an international system is first of all organizing within one's own country and after that a long educational process is needed in order to carry it on to the internat..onal scene. At this stage undoubtedly standardization of the items of data that are used in the system and not the means of the communication are essential. One of the points that I raised and Dr. Samuelson commented on was that of legal issues, and this could be a very significant one. An example was recently given in Datamation of a computer program on a magnetic tape that was crossing the border from US into Canada. The customs officials wanted to charge tax on the 20.000 dollars, which was the value of the work in creating the program. So, the person refused to pay the tax on this and the tape was sent back and the information was then sent by line across the border. Now there is at present no check on this. But obviously this is a very important legal problem because information is a commodity and so eventually there must be some method of paying for information even if it is just strictly over telephonelines without involving unacceptable types of censorship. Another feature of most of the modern systems which is undesirable is that the assumption always seems to be that the information is going from scientist to scientist. Last year at ASIS I spoke of channel hierarchies for dealing with users of information at various levels of sophistication. Of course the easy problem is that from scientist to scientist. But, when we are thinking in terms of national policy we hope that the basic research will be of use much lower down in the pyramid of sophistication where in fact innovation actually occurs, the innovation that leads to new products. This is of course a much more difficult problem and not a machine mediated one basically. In particular this is of importance in dealing with developing countries. It seems that the type of commodities that have been given to these peoples in the past, keeping them alive from day to day has not really helped in further development. Information is one of the commodities that is

needed most by these people, but it is not going to be helped by a system that gives you bibliographic references to articles in the Physics Revue. There are systems of course, the ones inaugurated by Mr. Kennedy and others, for getting young people into these countries and to provide information in the most direct way, living amongst the people. It seems that these human systems which are the key thing in transferring technology from sophisticated people to unsophisticated peoples should probably be backed up by international networks which will supply the high level information to the people taking part in this.

K. Samuelson

Thank you Dr. Amey. I am pleased that you touched upon this topic of developing countries and I will give some of the background in this respect. I had long ago invited representatives of the FID/DC (Developing Countries) committee to take part in this panel and come up with some viewpoints. However, the yearly FID conference is later on this month in Rome and there are always problems of attending two international meetings, so unfortunately we do not have a representative from the FID/DC here with us. Anyhow, myself being on the system analysis side I feel exactly the same way as a DC member: Who should I join? Which way should I go? Just in order to explain this point of view I am going into the details of this hypothetical network. I would like to take the position of being a user from a "have-not" region, at a terminal which could be connected and where I could set up communications with one of the various data bases or source data bases which I have termed master bases (Fig. 1.). Let us say that this is me (located at an isolated terminal), I am the user who actually should be placed in this area. I have nothing but a terminal or I might not even have a terminal but only desires for information. I am asked to pay a certain price for information, What kind of information would I need originally? Would I need, let us say, a microform library of essential documents in the field delivered at various intervals and which is not a retrieval system but certainly is essential information? Or, would I be prepared to subscribe

to the various secondary services in these areas? Then, I immediately find myself in a geographical position where efficiency depends on communication time and is a matter of global service hours. You just have to arrive at an airport with a late plane in the middle of the night, like I did yesterday, and will find that most activities are closed down and you cannot get into communication with whatever aids, services and facilities you would like to. The same problem is going to affect information communication regardless whether it is in one part of the world or another. I would say that already at this point it is not a matter of supporting existing operational services and let them do the job. It is a crucial decision already now. Maybe we should be creating a center on an island in the middle of the ocean or, well most likely not I assume, because it is a matter of civilization and people being around this area. There are certainly best-alternative areas. I recall there was a comment in 1967 at the FID conference in Tokyo when one Australian member said that Australia in many respects is not a development country but in the area of information service it certainly is in lack of existing operations. They also have a time-wise problem of communication and so will all the other nations in the world have to some extent. That is something which should be brought to attention as a systems analysis problem at a policy planning level at an early stage. Now, I'd like to get back to the second round of this discussion and Dr. Adams has submitted some comments which were phrased as: "Could we make a clarified distinction between a system and a network and say that a system is associated functions under a single management while a network would be associated functions under multiple managements." I would go along with that although I might say that a network is a system as well. So, I'll rather say that a network is a total system and the single managements would be subsystems, but it is just a matter of semantics as Dr. Adams expressed it. I would like Dr. Adams to continue this context:

S. Adams:

I like to restate that if I may, because I think it is a little more fundamental and being a matter of semantics. Indeed as we approach the whole problem of systems design it seems to me that we have totally overlooked the management function and the importance of the management function in the arrival at decisions in which routes you go. I do distinguish in my own mind and it does help me to clarify a little bit the single management concept that underlies the development of a system "per se" and the multiplicity of management functions and hence the compromises that must go into the development of a network. There you have nodes which maybe operating under multiple managements, but none the less you must decide on and determine certain common conventions for purposes of intercommunication and certain standards. I think in the UNISIST activity that I spoke of really we are concerned more with networking, that is with developing interrelationsships, voluntary cooperative interrelationsships between and among systems in various theories of sciences and between various language units than we are thinking in terms of a single system under a single management concept. This will be totally impracticable and totally undesirable politically. While I am on this subject if I may, I would like to say on the basis of some three years operating experience in the internationalizing of a system MEDLARS through the medium of OECD I would like to make an observation that it seems to me there are two fundamental approaches which can be taken to such internationalisation. One, and they are represented at the table here, and I will be very much interested in having my colleague from INIS, INEA comment on this. One approach is essentially that of a system developed by one country, and this we have referred to a little bit earlier, beeing shared with another country. This is essentially the pattern that MEDLARS has developed in. We have shared this not only nationally with the ten centers involved in this, but internationally in Stockholm, U.K., France and Germany in the near future. Now, in order to provide for management participation in such international sharing we have created a group outside the U.S. to concern

itself with the technical management of a system as a whole. The pattern none the less is that of a system developed within a country, funded by that country and yet shared internationally with other countries. As opposed to this you have INIS, which is essentially a system developed by an international organisation "de novo" using the best of technical expertise and consultation in the development of a system. EURATOM as a matter of fact developed along approximately the same lines. So, here we have two different philosophies in the way of which systems may become international. I think it is too early yet for any of us to draw conclusions on the basis of the experience we have had to date which is the preferable mode and that is why in my earlier comments I kept this wide open. I think we will approach this question of internationalizing systems through many doors and through many different pathways. But I should be very much interested in having our colleague from Vienna discuss the advantages and the disadvantages of putting a system together by an international team.

M. Komurka:

I can say to this problem that I think there are a few people who started in fact as the first consultants when the system was put as a first design project. When we talk about for example EURATOM and the INIS system there are two quite different bases in both systems. I think EURATOM is a very well worked out system as a retrieval system, but it is based on abstracts which are used in the system and the EURATOM system does not deal with the bibliographical data. When we started to think about an international system we also took into consideration the NSA service and the idea at the time was that perhaps there could be two ways of cooperation with NSA. One was to take over the NSA servics and the second was to take the service of INIS to NSA. This is still under discussion but we think that even NSA could use the INIS service because at the end the abstracts which will come to the INIS system will be much earlier available for NSA than through other channels. In fact we try to use as much experiences

as possible from the EURATOM system. We have concluded a contract with EURATOM according to which the INIS system will get from EURATOM the whole bit program which is the so called processing of index terms. We shall use the EURATOM thesaurus even if in a somewhat modified way. So, in this way we tried to share the responsibility and the experiences which were gained at many places, in the developing of the INIS system.

K. Samuelson:

This still confirms the approach that FID/TM has taken. In other words, we did not say the design of one system, we don't anticipate that, we rather say and estimate that there will be several automated systems in operation and systems which have different principles of operation and different structures. The things we would like to be aware of are: What can this system offer from a users point of view? In which decision situation and time of the day should the user try to approach the services of one network and in what other decision situation and time should he try another network and so on? This still confirms the relevance of the approach that we have taken, Now, I am very pleased to welcome Dr. Borko to the panel. Although Dr. Borko does not need an introduction before this audience I am very pleased that he is on the panel and as a systems analyst he can describe some of these expert aspects within the frame of FID/TM.

H. Borko:

I hate to begin talking by making an apology, but clearly this is needed, although I feel that the planners of the meeting should appologize rather than I. It was printed in the program that I was supposed to be at two places at once. I realize that I am somewhat schizophrenic, but I don't think they ought to advertize this fact.

Essentially my approach in the FID/TM committee has been to pleed as strongly as I know how, for the value of beginning the planning by adapting the techniques, the procedures of systems analysis and design. I said that I stress the word beginning because I feel that the systems approach should be integrated in the planning at the very beginning.

Normally or all too often what happens is that most of the administrative and managerial decision are made before the systems analyst is brought into the picture. I feel very strongly that this limits the value of the systems approach. By having cut off many of the options available at the early planning stage - you might think of it in terms of a tree process, a decision making process - you have lopped off all of the branches so that there is really just a straight path that one could go, and now you bring in a system analyst and say: "OK this is the path, there are problems, what are you going to do about it?" My approach is, well, gee that is the wrong problem, let us go back and see all of the things that has been done and maybe there are other ways of solving the problem. The example that I was able to hear should it be a monolithic system or should that be a coordination of many systems. This is not something that one decides a priori. This is in terms of what are our aims. What are the constraints? At the very beginning planning stages the systems analyst ought to be brought in. He ought to look at the purposes of, for want of a better word the system with small "s" and then see what is the best way of achieving these. The first point that I would like to make at the panel is that the systems approach be integrated at the very beginning in the planning stages. A second point that I would like to make is that the systems approach which is basically a procedure, it is a process for studying complex situations for dividing a tremendously complex problem into component parts that can be conceptualized that can be handled by one or a small number of people; So that the components or subsystems, to use the lingo of the systems analyst can be studied, can be analysed, can be dealt with and the interrelationship of these subsystems made very clear. Generally again, and all too often as far as I am concerned, the systems approach is used when dealing with hardware systems almost exclusively. In other words, we sort of developed this in terms of building a missile system and the conceptualisation that many people uses: "OK this is a good approach if we are dealing with hardware". My plea is that, yes it is a good

approach but a systems approach is far broader than a hardware system. Any system is embeded in a large social, psychological, economic and political complex and the systems approach helps us to understand the problem of the total environment in which the system is going to be embeded, not just the hardware. The systems approach, can indeed be used in analysing some of the many political international problems that something like the world science information exchange or EURATOM or INIS etc is concerned with. It is not just hardware. Indeed in any business organization where we talk about just putting in a computer system there are many psychological, sociological and political, in the broader sence of the word, constraints. I mean the management might already have a certain computer system, which we must use, it is part of our constraints; or the president's brother in law is going to have to operate this and if we do not design our system so he can do it they are not going to implement it. These are constraints which the designer must be aware of and must take into account in doing his systems analysis. The systems approach has indeed been used to handle this kind of broad problems. One of the best examples is in my own state of California. Exgovernor Brown hired a number of systems people to look at some of the problems in the state of California, education, vaste removal, law enforcement from a systems point of view. Mayor Lindsay in New York, who has an impossible system of running New York City, attempted to use the systems approach. and hired a systems group to analyse these problems, to break it up into subsystems the way that it can be done. My second plea is that we recognize that the systems approach, basically a process, a method of studying complex situations, is much broader than just a machine system. It is in truth a man-machine system embeded in a large socio-economic environment and the systems approach is applicable for this kind of study.

K. Samuelson:

Thank you Dr. Borko. After this state-of-the-art of systems analysis in the field of information networks I would like to invite the audience to join the panel in a dialogue based on these concepts as outlined by Dr. Borko.

Before I leave the word open I will ask if there is anybody in the panel, who would like to make one or two minutes short comments within the context just emphasized, and after that I will leave the word open.

H. Koller:

I don't want my remark to be misinterpreted. I should say some of my best friends are systems analysts, Hal is one of them. I think that several of the panelists have spoken for the merit of a grand design probably arrived at by systems analysis approach. I think conceptually this is good, it is no question, it is better than trying to path something up afterwards and figure out what you have done; I think in terms of developing international information networks, particularly if we are talking about scientific and technical information. In most of the fields that I think we are talking about, scientific and technological information the fact is, that there exist already some very large national systems with huge databases that have been put together with enormous amounts of money and labor. There are efforts that are well under way to commercialize some of these. I think that the emphasis should be to possibly apply the system analysis techniques to creating the links between these systems which allows say for translations that are internal to the systems from one individual to another that the users not even be aware of. But at the design of the details of the overall system they get down to the specific file level for example or the specific searching program level, are things that are probably too late to tamper with now.

S. Adams:

I would like to confirm what Dr. Koller has said. It seems to me the problem, the large fundamental underlying problem in systems design has been the development of large data bases by the more affluent countries and their exploitation their utilization for purposes of national economic, scientific, technological development by other agencies. This is fine when you have a level of technological competence as for example we have in Sweden with Dr. Tell, but when it comes to

a developing country you are up against the wall to try to find a mechanism which can provide services at the low level and I mean this, technologically low level that the developing country requires from such systems. That is one of the problems that UNISIST is wrestling with at the present time.

K. Samuelson:

Before I leave the word to the audience I will make one more comment in this context, that is: For a number of years we will be running parallel systems and the attitude between some of these parallel networks or operations has been a competitive approach. Now, I don't see that as a necessary evil, I think it is something which should be as a matter of fact, supported. The only thing which might happen after an amount of years is that one operation will be running the same information field as another operation and one of them turns out to be the loser in terms of having users of the system and the service. That customer-lacking operation could then be advised on course-of-action correction through international coordinaing bodies having systems analysis experts as consultants for questions like: In which way should they modify their operation or in which ways should both operations be altered, or all three or how many you have? In what way should they be advised to modify their operations in order to contribute to the overall, total goals. Now, I'd like to give the word open to the audience and before you make your comments would you kindly please state your name and organization.

E. Marden, National Bureau of Standards:

I agree with Harold that the systems people should be called in early, but I would respectfully submit this is where we were 5-10 years ago. I do not mean to denudgrate what you had said Harold. Also it seems Dr. Amey suggested standards. These two are important for interchange of information, but in his last remarks Dr. Samuelson implied performance evaluation, when he is talking about modification between systems. If you have competing systems, systems in parallel, it seems to me that we

from the systems analysis initiation to the development of standards, there is a very large "hiatus". There is a step, we probably has recognized it, but we have not stated it explicitly. There is a very important step in between and that is a systems performance evaluation, Thus, you must have the feed back, you must have the performance evaluation, the necessary modification and a fair amount of experience in using the system after modification, before you can develop meanful standards or we will be stuck with something we don't want.

H. Borko:

As to whether we were there five years ago Ethel, I am not sure but this is the "up-till-battle" that I am trying to fight. Perhaps if our systems people were brought in earlier we might have made a little bit more progress, I don't know, it is a pious hope. But, there is no question, that in the design of a system one of the very important aspects of a good design is to provide the data for evaluation. Now again, one should not, and this is a plea, one should not design a system and finish it and then say: "OK you figure out how to evaluate it." The evaluation criteria is part of the design. The gathering of data for using evaluation is part of a design. There is no sence building anything whether it be a moustrap or a EURATOM unless you can decide whether it has done the job properly. In the design phase in the very early planning stage you figure out, when we know our purposes, how do we know we have to achieve this purpose and what data do we need to measure how effective the system was. This kind of data has to be designed into the system from its beginning so that we have a basis for evaluation. Let me add that a design of a system, and I am using system in the broader sense, call it network, the entire man-machine environment, is never finished. It is a constantly changing in evolving structure and a good design allows for such evolution and change through the process of constant evaluation. Otherwise you don't have a design, you have built a dead system.

E. Marden:

I apologize Hal, I didn't really mean to say that there was anything wrong with your statement. Perhaps there was something implied that I did not quite recognize. What I meant to say was that we were paying "lip-service" 5-10 years ago to saying that the systems analyst should be brought in at the beginning. I agree with you, a good design of an experiment would have built into it all of the evaluation procedures, again I apologize.

G.X. Amey:

Well, ideally one should design the perfect system at the beginning. It seems to me that since we don't really know enough about information systems and also the new type of hardware that keeps coming up. By the nature of things these systems are continually evolving therefore it is essentially impossible to decide in advance exactly what you require. However, you no doubt have to decide on measures as you go along which will enable you to evaluate the system. I certainly don't think that when you start off you really have any idea of what kind of a system you are going to wind up with at the end, however, good your intentions.

B. Vickery:

Just a small point backing up the systems analysis approach. I agree with Dr. Koller that one is forced willy-nilly to combine pre-existing factors and components in the shape of the large information systems that already exist. I think the fact of going international inevitably causes considerable . . changes in those components and therefore the need for systems thinking about the whole problem comes up much more sharply. I mean, going international in the first place, as several people have mentioned, means that your users now become very much more heterogenous, very much more levels of technological consiousness and so on and this is going to modify in fact the aims of the system. Secondly, I think it is true to say that all the systems that are going international are also beginning to internationalize their input. MEDLARS is now getting indexing

done outside the U.S., this is true of the INIS-plans and so on, it is true of the American Chemical Society. This internationalizing input raises very big problems of index consistency and so on, quite new problems which have to be thought about in a systematic way, if they are going to be solved satisfactorily. So that, it is not just a question of making the whole thing bigger, it is a question of beginning to change the nature of the system that you are dealing with and this needs fresh thinking.

S. Adams:

Let me say I think there is a problem area that we have not touched upon at all. I think Mr. Vickery's comments a moment ago got into this area, where he talks about internationalizing of input. The problem I would like to dwell on for just a moment is that of natural language. A little anecdote here: In the MEDLARS system we index aproximately 125 Soviet Journals we do not touch their introdee, which I think are extremely important in any field of science. In an international conference last May we brought this up with the Russians, they offered to provide indexing input from some 10.000 scientific papers included an introdee. This was fine, except we told them that in order for them to be meaningful within the MEDLARS system they would have to be a MEDLARS-style and that means that the indexers would have to be trained within the U.S. Immediately we had a political barrier. That is the problem of offering training. INIS, I think through the centralized control, that is why I spoke of some of the advantages of using this international approach, has been able to sum out such a problem of this sort. But, to come back to the language question. There is a group that is unfortunately not represented on your panel, Dr. Samuelson, it was to be I think, by Dr. Phyllis Parkins, and that is ICSU-AB or Abstracting Bord of the International Council of Scientific Unions. They are doing some rather important exploratory work in this general area. For example we make a number of assumptions about polyglot or poly-lingual thesauri. Are these in fact possible? - I don't know. I mean I have got a number of questions about the possibility of jumping over the language

barrier but at the same time I think there are a number of questions relating to the development of poly-lingual thesauri so the systems may be used in the natural language by a variety of countries, that have yet to be answered. There is the question of partial synonymy for example in the scientific vocabularies, as each of them develops in individual language areas. There is the question of the logical interrelationship of the terminology, of the concepts in any area of science. To what extent are these influenced by the educational systems in country A as compared to country B. So I think, there are a number of problems which have yet to be identified. We have not even started to ask questions about them, before we can talk in confident terms about the ease of internationalizing any one of these large systems. I did not mean to talk too long about this, but it is not entirely a matter of technical compatibility, there are a great many things relating to the cultures of the different countries, for example that must be taken into account.

K. Samuelson:

The two concepts and design parameters mentioned by Dr. Vickery and Dr. Adams would refer to coverage and span-of-contents. From the systems analysis point of view I had emphasized that there has not yet been made a functional formalization regarding the interrelationship of this last design parameter namely coverage and cost-effectiveness on the other hand. We simply do not know "what price information?" and it might well be that it very much dependson timeliness and response, so even if we cover a large content area, by the time we might get the information it might be obsolete. It is all a matter of arriving at and perceiving one total picture of structural systems design concepts.

B. Tell:

I should like to come back to what Dr. Vickery said, what happens when you go international, and he pointed out what happens in the system. We have to deal also with another point which is: When for instance several countries should make the input to an international system, who is going to pay for this?

This is a policy decision. The national government is one day confronted with the fact that here you have an international system which has been paid by subscription and then some people in your country are obliged to make an input, for instance to the INIS system and who is going to pay for this? So this is a policy issue, which is not so easy to solve, but which has been one of the concerns of OECD. In order to settle this from an international point of view OECD has tried to establish a sort of <u>focal points</u> in each country. They have developed rather fast from an international point of view. I think during the last year about 8 or 10 such focal points were set up. Sometimes things can happen very fast even in an international organization. When OECD once thought that it might be wise to confront countries about their science policy they sent out an invitation to the science ministers of the member countries and overnight I believe 14 science ministers were created in different countries. I think that as soon as these focal points have been established: We have established now three in Scandinavia and are waiting just for Denmark and in the other countries they will come also. U.S. has already by Colonel Andy Aines' office a focal point. These focal points will form a new international network and it will be <u>regional</u> networks by then, but here you are stuck with a, let us say a socio-psychological problem. You have to have these people to talk the title to and shake down the community so they can really start to find out what they shall achieve. The economic question is just one, of course important question, for a finance minister or country, but it <u>(cost) is a small problem from the point of view of international cooperation</u>. However, economics has always had a sort of character to creep up everywhere and therefore in the information field one of the very first things that was created was a panel for the economics of information. Now after about five years they have found that the only thing they will do is to send out a questionaire and they have changed their name also so they will call themselves a sort of management panel. What I wanted to say is that if you are going international and you are starting to count upon the participation of different countries then a lot of

quite other problems are creeping up when you are dealing with one system or dealing with another for instance bilateral and so on.

K. Samuelson:

It seems to me that since these regions (Fig. 1) are all in the same area you have not had to consider the problem of communicating during non-daytime and after-office hours. You do not have the problem of calling up each other in the middle of the night, whereas I, where I put myself in a position up at the north pole or maybe on the south pole, I have to wake you up in the middle of the night to get the answer to my question, which is based on a critical decision - and I am willing to pay so and so much for information at that particular hour and with the requested mode-of-presentation. display and delivery.

H. Borko:

Just a comment on what Dr. Tell indicated. I think all too frequently in the U.S., and unless I misunderstood as rub-off on my own education, we have had the feeling here that, concerning the underdeveloped countries, the policy decisions had to be made at the underdeveloped countries as to whether they pay for the services. Let me point out that this is a decision, a very real decision and policy point for the U.S. and one which we are not given as yet adequate attention to in my opinion. If information is indeed a very valuable resource for which our citizens and taxpayers are contributing, should the U.S. give it out for free? If at the present time at least in some of our policies we kind of ask for a "quid pro quo", you know we will give you something if you give us something equally valuable; Is this the policy that we want to continue? Can information flow from the eastern block countries? Or from our country freely, i.e. with no economic strings attached, to the eastern block countries, would we be in favour of this? In other words, this is not just a policy of asking underdeveloped countries to contribute some economic support to the system. The problem is far more complex and I think it

is a problem that we in the information field in the U.S. need to be given much more attention to and when we have our own views, let our representatives know about how we feel about it. It is not just someone elses problem and that is the only point I want to make.

K. Samuelson:

I think now we are approaching the concept of costs and pricing at a proper level and after Dr. Adams has made some comments we might ask if there is anybody in the audience representing the information industries or secondary services. I would say from the system analysis point of view that it is perfectly possible to assign costs and prices to most of the listed design parameters. Just as you have different prices for using a telephone service at various times of the day and it is less expensive after 6 o'clock, then you can calculate computer costs and know how much transmission costs. You also know how much it coststo search free text compared to index text or inverted files, and finally know about different hardware utilities, costs and so on. Thorough systems analysis for each specific point of view is definitely feasible.

S. Adams:

I simply want to comment, and Dr. Borko already touched on it, that so far as those systems which are federally supported, or federally operated are concerned, they are subject to a COSATI policy, developed by the COSATI international panel and seen through COSATI and through the Federal Council on Science for Technology, which does involve a "quit pro quo". MEDLARS, AEC for example have all subscribed to this policy. This counts for the internationalization of the input (contents) or for instance in the MEDLARS system, where each country as a participant, that is as a "quit pro quo" does provide input at a significant level to the system. The special case of the developing country that Dr. Borko has raised, is a little tougher. Now there exists in this country of course an Agency for International Development, which does offer, in so far as

the Congress appropriates, funds to accomplish this, which does offer development capability for the less privileged countries of the world. MEDLARS is available to these countries through reemboursement from the Agency for International Development. How much longer it can be subsidized, or the service of anyone of these systems can be subsidized by a national interest is a matter of political decision. The West Germans by the way have such a government agency also which is oriented towards the provision of technological information services to Africa and these are supported by the more developed countries. But, is this a sound economic base? I think we have got some political-economical questions to answer here. How long can we continue on this kind of a systems program?

M. Komurka:

To this problem I can say that at the Agency there were also a lot of discussions on: Who should pay the input? What should be paid for the output? etc. At the end it was agreed that all input to the system will be provided free of charge. Also the processing of the input at the agency will in fact be paid by the budget of the agency. Regarding to the output from the system, i.e. magnetic tape service, it will be provided on the basis of exchange for empty tapes which means that for the processing there will be no charges. Then there will also be output in the form of printed lists and microfiches of abstracts and full text documents. We follow the previous policy of the agency which means that a certain amount of microfiches will be provided free of charge and the rest, if a country is asking for more copies, we shall charge for those extra copies. Also if a developing country is asking for perhaps SDI or retrospective searches they will have to pay for that service.

K. Samuelson:

I had the impression during this final dialog that the last comments which have been made furthermore emphasize the fact that most of the thinking is going on in terms of contents

input to networks but not necessarily automated networks in the true sense. We may anticipate this situation for a considerable length of time and for several years to come. if we are pessimistic perhaps. I would like to express that the FID/TM-committee is strictly concerned with these problems and there are systems analysis experts as a majority in this committee who would be very pleased to receive your comments, maintain further correspondence with anyone in the audience who has questions on these topics in the future. It is work which will continue within the committee, so at any time please write us. The FID/TM secretariat is in Stockholm at the Royal Institute of Technology, c/o my name. Before calling off the session I would like to thank the panel, the audience and our ASIS hosts for the assistance in handling the tape-recording and I hope something stayed on it. For fall-back possibilities I will ask everyone on the panel who eventually kept notes on this session, please save whatever notes you have made so if nothing became taped I may still have information stored on some kind of hardcopy.
Finally, may I thank all of you for showing an interest in this field and joining us this morning. Thank you all.

Appendix 1.

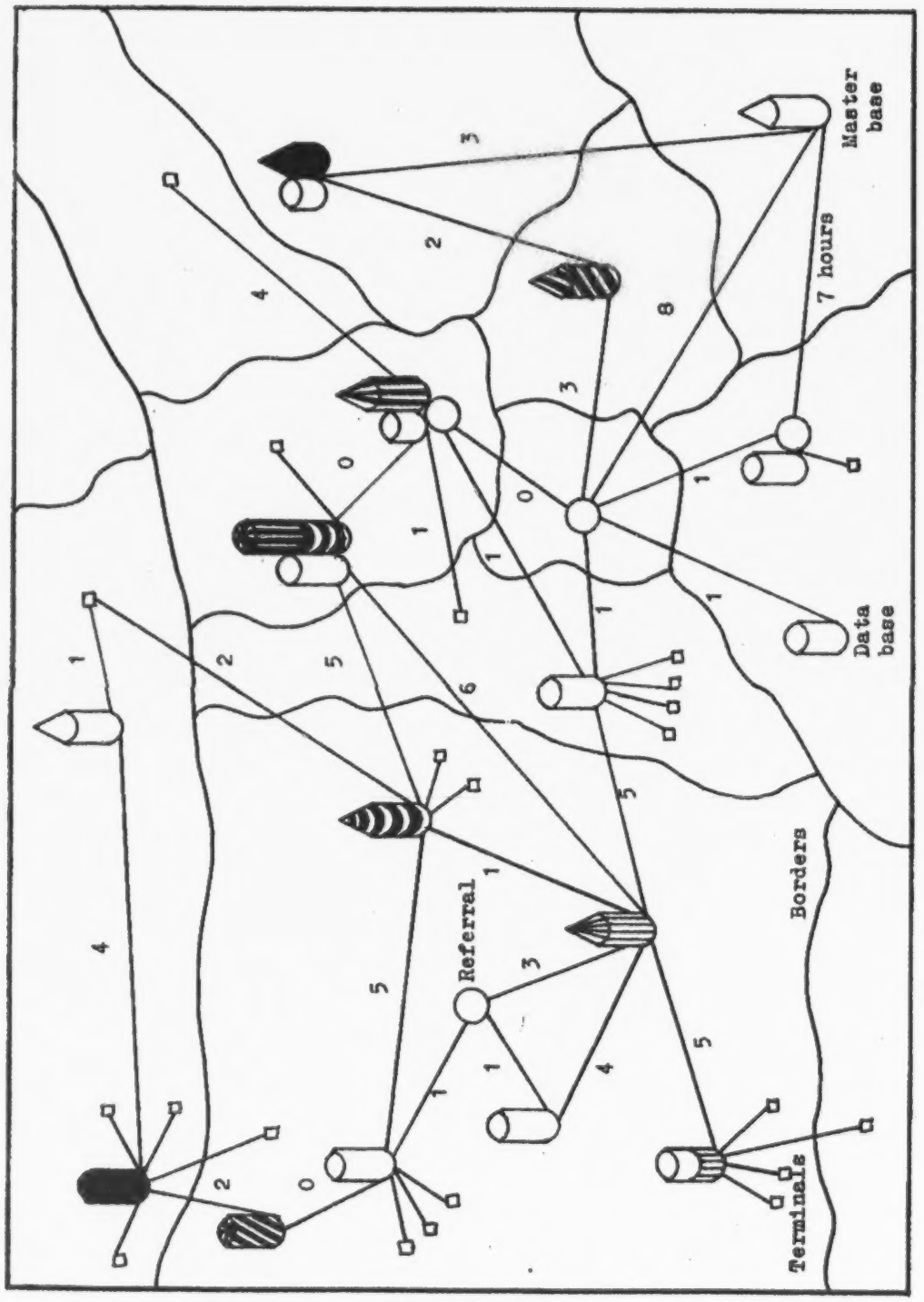

Fig. 1

Appendix 2.

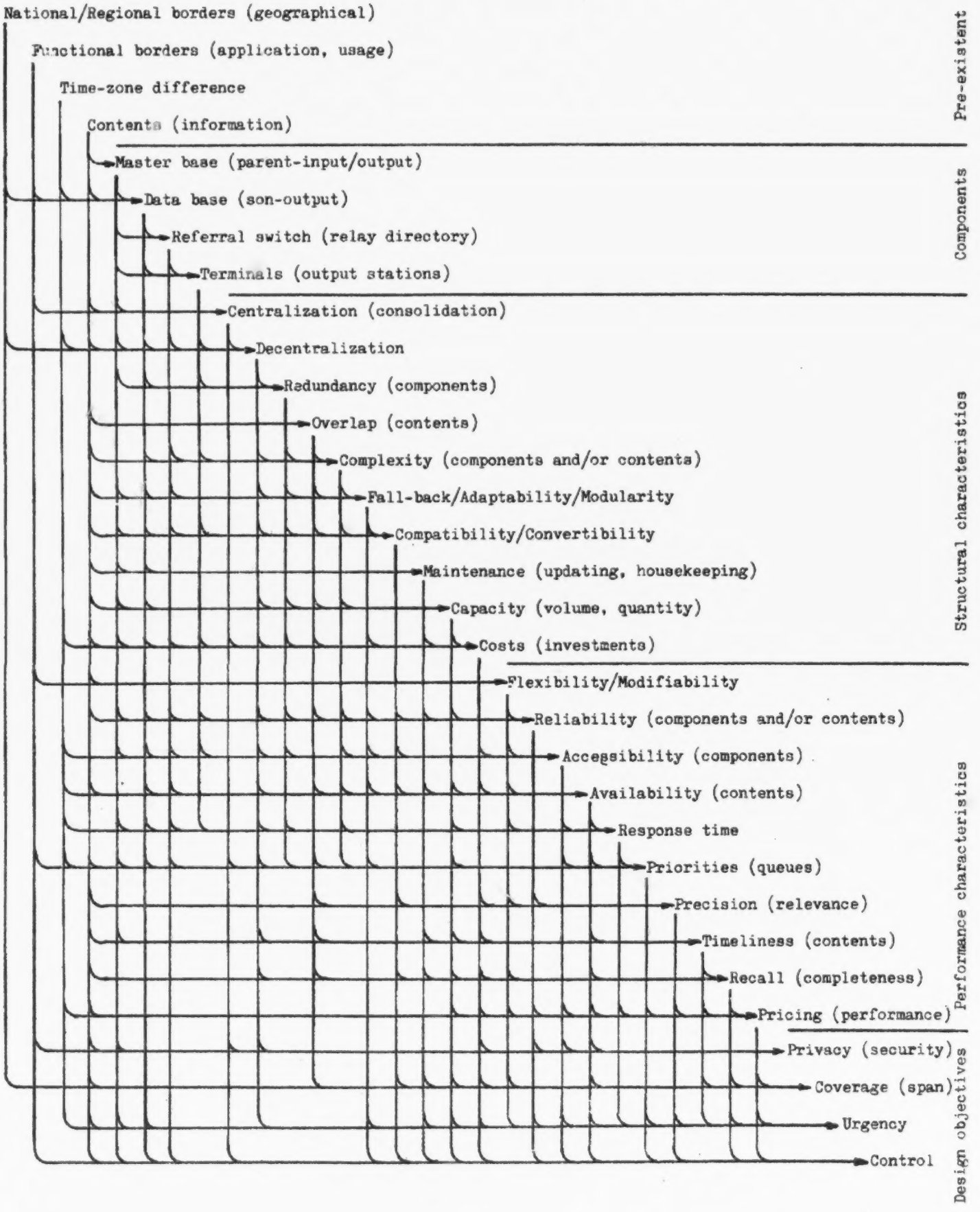

Fig. 2

Preliminary comments
by Dr. Scott Adams

I believe communication to be a social function of science. It follows that systems and systems networking design, which you have viewed in the background paper from the point of view of a systems engineer, and which other members of the panel will approach from the same position, to be successful must find answers to a series of socio-economic and political requirements. These you have just touched on in your table (p. 5) under the heading "Pre-existent".

But, as experience in trying to achieve systems interconnectibility for networking purposes and as the history of UNISIST demonstrates, these requirements have not yet been defined as "givens"; the scientific user communities in all countries, and the governmental policies relating to science information are in a state of flux. Certain trends can be observed and reported. Among these are:

1. OECD efforts at the political level to establish foci for science information policy within the governments of member states, and at the technical level of exploring standardization requirements for interconnectibility of systems.

2. UNISIST efforts, also concerned with standardization for interconnectibility, but in addition involving both East-West cooperation and the creation of mechanisms to ensure benefits to developing countries.

3. The recent establishment of an 8 member country International Center for Scientific and Technical Information in Moscow.

UNISIST is not considered as a scientifically designed world system; rather it is a program to insure collaboration among existing and developing systems. I can perhaps offer some personal hypotheses about the directions it might be desireable to take,

but they will be a priori, and not susceptible to the type of systems analysis your panel is concerned with. For example, it is my observation that processors of scientific information may be divided into two groups, the primary processors representing either a) supra-disciplinary fields of science (e.g. biology, chemistry) or b) centralized national efforts (e.g. CNRS or VINITI). Secondary processors have as their purpose the re-packaging of information for the purpose of inter-disciplinary problem solving in the sciences and technologies. An economic model would be based on improved interconnectibility of the primary processors to reduce costs of primary processing, and on sufficient standardization to permit the secondary processors ready access to large data bases for purposes of re-processing. Obviously the more they can reprocess, the less they will have to process originally, at high costs, and in a duplicative mode. It is these secondary processors to whom we must look for mechanisms, or network service points, whether based regionally (and that' s a big question) or nationally, to provide benefits for the developing countries.

Preliminary comments
by M. Komurka, International Atomic Energy Agency (IAEA)

International Nuclear Information System (INIS)
List of Priority Design Concepts

From 1966 onwards the International Atomic Energy Agency, in co-operation with its Member States and with the advice of expert consultants, has been developing an International Nuclear Information System (INIS). In establishing this system the Agency Secretariat has observed the following priority concepts - not necessarily in this order:

1. Awareness of existing information services
2. Minimization of central costs
3. Universal usefulness of the data base
4. Avoidance of linguistic problems
5. Compatibility with systems in other subject fields
6. Compatibility with hardware
7. Availability of full texts.

1. Awareness of existing information services

The design concepts of existing services such as Nuclear Science Abstracts, Euratom, etc. have been taken into consideration as far as possible.

2. Minimization of central costs

The total costs of the system consist of the local costs (in national currency) and the central costs (at the IAEA). It is hoped that maximum decentralization in input preparation will keep the costs to the IAEA as low as possible and spread the national costs equitably between large and small producers. In addition to decentralized input such concepts as co-ordinate indexing, centralized maintenance of the thesaurus and indexing control, and decentralized information retrieval were accepted.

3. Universal usefulness of the data base

A specialized data base (for S.D.I. or retrieval) would be cheaper than one that is also to be used as a source of bibliographic publications. However, although a universally useful data base will imply more sophisticated input preparation, a larger character set, slower sorting, etc., it offers greater flexibility and wider application.

4. Avoidance of linguistic problems

It was agreed to have only one working language for the system even though it is not the mother tongue of all inputters and users. Therefore it was also necessary to accept a subject control system that does not, too largely, depend on linguistic skills of indexers (co-ordinate indexing and controlled vocabulary).

5. Compatibility with systems in other subject fields

As a future exchange of data among various information systems is anticipated, an attempt has been made to ensure maximum compatibility with other mechanized systems both internationally and, as far as possible, nationally. The main consideration was to be able to merge data selected from two or more systems and produce a reasonably homogeneous output.

6. Compatibility with hardware

Member States of an international system must be able to take its products (including copies of its data base) into the hardware system that they have or can afford.

7. Availability of full texts

It is not enough for a system to give only references to documents. Users have to have access to full texts and the system must be designed so as to permit this.

Description of INTERNATIONAL NUCLEAR INFORMATION SYSTEM (INIS)

by M. Komurka
(International Atomic Energy Agency)

Introduction

Since 1966 the International Atomic Energy Agency (IAEA) and its Member States have been making an attempt to establish an International Nuclear Information System (INIS). Finally the IAEA Board of Governors, during its February 1969 session, gave its approval to the project. It is planned for INIS to become operational in 1970.

INIS involves multilateral co-operation between the IAEA and its Member States. The work will be shared and though the Agency will serve as the focus, its part in the work will be significantly less than the total amount done in Member States.

At present nuclear scientists and engineers are served by a large number of information systems of various degrees of sophistication. In the library of any nuclear establishment, one can find staff cataloguing the information available and searching for particular pieces of information that may be relevant to studies under way. Some establishments depend only on human effort, others support human effort with computers. But there is a great deal of duplication because it is essentially the same body of information that is being catalogued in all the different establishments.

With INIS new information will be catalogued just once - in the country where it is published, and then the separate batches of catalogue entries will be merged into a world file which will be copied and distributed to all concerned. Duplication will be avoided and computer technology will be employed to speed up the editing of entries, the compilation of the file and the distribution of this file in varied forms. Computers could also be used to extract from the file the particular entries that are necessary to meet particular needs.

It is believed that through co-operation on these lines, Member States will be able to use their own information staff to better effect. At the same time, many of the benefits of computer processing can become available in those establishments that have not as yet introduced computers for this part of their work. Finally INIS will be capable of providing a far greater variety of output services than conventional systems and many of these new services will be tailored to the needs of individual scientists and technologists, or groups of them.

Subject Scope

INIS will be concerned with the application of nuclear science and technology for peaceful purposes, as is the IAEA itself. The INIS subject scope covers those parts of physics, chemistry, metallurgy, earth sciences, biology, agriculture, medicine, health and safety in which nuclear phenomena are involved; isotope production, isotope and radiation applications, engineering and nuclear reactor technology; instrumentation required in nuclear science and its applications, and finally some additional aspects of nuclear energy such as economics, nuclear law, nuclear documentation, safeguards and computation.

After the subject scope had been approved the Board of Governors asked the Agency's Secretariat for a step-by-step implementation of the system which may mean that the subject scope will be restricted during the initial period of INIS operation.

It is envisaged that about 100 000 items per year will fall within the INIS subject scope.

Nuclear Literature Form

Once the subject scope had been agreed upon, it became necessary to decide on the forms of literature to be included and to ensure that all relevant information, available both nationally and internationally, would be brought into the system.

The various ways in which new scientific and technical literature is made public are such that some pieces are much more readily available than others. On the other hand, some pieces are not

distributed commercially and are therefore less readily available - they are called "non-conventional" (26% of the whole amount of literature expected). INIS distinguishes between conventional and non-conventional literature and while it will handle only descriptions and abstracts of conventional literature, it will provide both descriptions and abstracts and full texts of non-conventional literature.

Collection of Input

Responsibility for preparing input for INIS will lie mainly with Member States or regional centres formed by groups of Member States. The likely national distribution of nuclear literature is given in the list below:

Country	Percentage of the total input
USA	40
USSR	13
United Kingdom	8
Federal Republic of Germany	6
Japan	5
France	4
Italy	3
Netherlands	3
Scandinavia	3
Canada	2
German Democratic Republic	2
17 other countries	11

INPUT

Now that we have seen what is to be included in the system, the problem is to introduce that material into INIS in machine-readable form.

The preferred form of input is magnetic tape with punched paper tape as an alternative, but worksheets (Appendix I) are also acceptable. Thus countries with large annual production (about 70% of the total production) would send their entries in machine-readable form either on magnetic tape or on punched paper tape and for the remaining countries (about 30% of the

total production) the simplest and least error-producing procedure would be to provide the entries on standardized worksheets. This applies only to the initial period of INIS operation.

All input is provided to the Agency free of charge.

Descriptive Cataloguing

To each piece of newly published literature, both conventional and non-conventional, that come within the subject scope of INIS, the bibliographical data (i.e. subject category, author, title, where and when published, etc.) are allocated. These data are based on those of the original document and recorded according to a standard set of rules for INIS input. As for which data elements must or can be recorded, see Appendix II.

Indexing

Another aspect of INIS input preparation is the assigning of "indexing terms" to each entry so as to identify the subjects treated in the piece of literature described and to allow the retrieval by subject criteria. After evaluating the various methods which might have been suitable for INIS and starting from the principle of decentralized input, co-ordinate indexing was chosen. The thesaurus that has been developed and continuously updated by CID-Euratom would be well suited to this purpose and the IAEA is negotiating an agreement under which this thesaurus, together with associated codes of practice and computer programs could become available for use in INIS.

INIS Clearinghouse

INIS will have a basic responsibility not only to bring the nuclear literature to the notice of all Member States in a form which permits retrieval by both formal and subject criteria, but also to ensure the availability of the documents thus identified. In practice the Member States will be responsible for providing the INIS Clearinghouse with a typewritten abstract of each piece of literature in a specified format and with the full text of each piece of non-conventional literature, either as originally published or as microfiches to a standard specification.

Processing and Storage of INIS Input at the IAEA

The IAEA will edit, check and process all input as it is received, thus building up a comprehensive store of information covering the nuclear literature published throughout the world.

Bibliographical descriptions and indexing terms will be processed by the Agency's. IBM-360/30 computer and stored on magnetic tape.

Abstracts of all literature and full texts of non-conventional literature will be put on microfiche and stored in this form.

OUTPUT

INIS will provide a magnetic tape service, its related printout - the INIS List of References (with indexes), authorities and guides and from the Clearinghouse service abstracts and full texts.

Magnetic Tapes

Since it has been planned to send out tapes semimonthly, INIS should be providing the fastest and most complete indexing service in this field. Thus it will be a suitable basis for S.D.I. (Selective Dissemination of Information), which may well become its most important use. Further, with bibliographical descriptions and a highly standardized keyword structure, retrospective searching can be produced as the cumulative store increases. In addition to that special announcement bulletins on different subjects could easily be printed out.

All copies of the magnetic tapes on which input is recorded will be provided to participating Governments in exchange for blank tapes (or for the cost of new tapes).

INIS List of References

This bulletin, printed twice a month, will contain the same information as the magnetic tapes. It will be a source of information for manual searching and a catalogue for indicating the availability of documents in the INIS Clearinghouse and in the conventional periodical literature. Thus it will serve for users at all levels, even for countries receiving magnetic tapes.

In addition, cumulative author and corporate author indexes will be printed twice a year.

A small number of copies of this bulletin and of the indexes to it will be provided free of charge to Governments. All other subscribers to the service will pay an annual charge designed to cover at least the "run-on" costs of printing.

Authorities and Guides

These bibliographical tools are essential for maintaining consistency of the file and provide the standards on which input and output are based (i.e. rules for descriptive cataloguing, authority lists of corporate entries, report number prefixes and periodical titles, the INIS thesaurus, magnetic tape and paper tape specifications and record formats, specifications of the formats of abstracts, etc.)

Clearinghouse Service

In addition to the INIS List of References (printed twice a month) Member States will receive a complete set of abstracts of both conventional and non-conventional literature on microfiches. Those interested can get full texts of pieces of non-conventional literature, either individually or as complete sets on microfiches.

No microfiches will be issued free of charge. Prices for them will be established to meet the costs of production.

It is expected that Member States will use all these products as the foundation in their national information services for the provision of the more specialized services needed by individual scientists and engineers, either individually or as groups.

Organizational Aspects

National information centres designated by IAEA Member States will be responsible for processing their national literature in accordance with the standards and rules of INIS and for providing their input in the proposed volume and range.

The IAEA, through its Division of Scientific and Technical Information, will be responsible for co-ordinating the work of national centres, for processing and controlling the input so as to be able to distribute the totality in merged form to its Member States.

In conclusion, I should like to summarize the duties and functions of both the national information centres and the IAEA.

National information centres will:

- review the literature published in their countries and select the suitable material in accordance with the subject scope adopted for INIS;
- catalogue and index the selected material for regular submission to INIS, providing also an informative abstract in any one of the four official languages of the IAEA;
- supply the IAEA Clearinghouse with one copy (either full-size or microfiche) of all reports, conference papers and patents, in the original language in accordance with the INIS subject scope.

IAEA will:

- co-ordinate and check the work of national centres in preparing the input and prepare input data for its own publications;
- distribute regularly to Member States the magnetic tapes, the printed List of References, indexes and abstracts (in microfiche form);
- make available through the INIS Clearinghouse reports, patents and conference papers in microfiche form;
- co-ordinate the work of INIS with other international information systems and abstracting periodicals;
- study the requirements of developing countries for other types of information services, e.g. S.D.I. and retrospective searches, bibliographic surveys and make special arrangements for this work to be done.

Acknowledgements

In the development of the INIS proposal the advice and suggestions of a great many consultants have been brought together. Their ideas and suggestions were discussed at several panels of experts nominated by a representative group of the IAEA Member States. The first documented proposal was made in 1966 and the last panel was held in May 1969. The IAEA appreciates the great amount of time and enthusiasm that its consultants have put into this work and hopes, that as a result, the INIS proposal satisfactorily reflects the needs of all its Member States.

Preliminary comments
by Dr. B. Tell

About the priority list over design concepts for Information Systems and Networks, I should like as chairman of the OECD Information Policy Group/Systems Panel to express the following priorities. From a policy point of view the goal must be to assure authoritative, accurate, objective and technically sound information to governments and to industry.
Therefore, the following issues rank high:

Referral switch
Availability
Precision
Recall
Coverage

In close connection come

Response time
Timeliness
Urgency

From an international standpoint factors like

National borders
Terminals
Centralization

also are of importance.

Preliminary comments
by M.F. Lynch, Sheffield, U.K.

At this stage in long-range systems design of large-scale networks, it seems inappropriate to use a finely-graded scale for assessing the importance of structural and performance criteria. At best, it is probable that no more than a two- or three-way subdivision of these concepts, in order of initial importance, is advisable.

Accordingly, design concepts relating to structural and performance characteristics are ranked as "High", "Medium" or "Low" in the table below.

High	Medium	Low
Costs	Capacity	Overlap
Fall-back	Compatibility	
Maintenance	Centralization/Decentralization	
Redundancy/Complexity		

Table 1. Ranking of structural characteristics of networks.

Two over-riding considerations seem to be operative in term of structural characteristics. These are as seen from the differing viewpoints (a) of the nations participating in and contributing to network organization, and (b) the utility of the network as perceived by the users, who in the first instance are likely to be scientists and technologists. Thus from the national viewpoint, costs are of cardinal importance. While the user will also be aware of this factor, it is, in general, borne by the user's institution; the user seems more likely to be affected by the reliability of the network. If he is to have confidence in it, and thus, as a community, provide support for its maintenance, he must not be allowed to be frustrated by systems failures. It is probable that he will be more tolerant of performance characteristics. Therefore, fall-back, maintenance, and redundancy by components must rank high in precedence.

At the other extreme, overlap in contents seemsleast important, provided it is not extreme. It is inevitable in current information-seeking activities, and there is no evidence for its being detrimental.

On the other hand, capacity, compatibility, and the question of centralization/decentralization seem significant, but not of primary importance. In particular, the centralization/decentralization question must often be a national issue, determined by costs, prestige and political approaches. It is presumed that compatibility, at least of message formats, is assured.

High	Medium	Low
Flexibility	Pricing	Priorities
Reliability	Availability	Timeliness
Response time	Recall	
Accessibility	Precision	

Table 2. Ranking of Performance Characteristics of Networks.

Performance characteristics are those that will primarily be assessed by the user. Reliability is critically important, as also accessibility, if the widespread support of user communities is to be gained. Response time, while using a component, especially interactive, is again critical, although it is not improbable that queuing priorities are less so - i.e., the user will be content to wait hours or days for access to a terminal, but once using it will expect rapid response. Thus priorities/queuing is ranked low; timeliness also comes in this category, since users already have learned to live with this problem.

Again, the user is likely to be tolerant of precision/recall considerations, and indeed, is mostly unaware of the latter.

In time, the user is likely to become more critical in his assessment of performance. His assessment of the relative ranking of these characteristics may thus change as his familiarity increases, and his expectations and demands increase.

Preliminary comments
by G.X. Amey

PRIORITIES

1. National studies of the information problem.
   1.1 Establish value of STEI; high-level organizations to handle problem.
   1.2 Involve existing organizations; encourage cost-effectiveness studies of systems.
   1.3 Develop technical expertise; methods for continuous evaluation of systems.

2. International studies of information problem (OECD, FID, IFIPS, ISO, AGARD) (overlaps 1).
   2.1 Attack legal problems; taxes on information, copyright.
   2.2 Standardization of communication media, data elements etc.

3. Distribute responsibilites within nations; responsible agencies.
   3.1 Allocate national STEI budgets to co-operating agencies.
   3.2 Determine accounting procedures; internal and external operation.
   3.3 Develop total system with full redundancy.

Notes on Priorities:
In selecting the above priorites, I have placed greater emphasis on the socio-economic aspects of the total system than on technical problems, which appear to me to be essentially trivial.

The experience in the United States with COSATI, and my own more recent experience with studies in Canada of STEI (Scientific, Technical, Economic Information) have shown that the mechanics of working with large organizations is infinitely more complex than any computerized information system. System designers tend to ignore this situation - to their regret in the long run.

Thus I must place first priority on the problem of selling the concept to those in a position to further it vigorously, - or to destroy it overtly or covertly.

This first requires establishment of the value of information in relation to research (See DR196 p. 19)(Ref 5.) which also discusses the concept of source and "such" countries. It is imperative that STEI be dealt with at a very high level - political level - if international systems are to get off the ground. The role of the communication of information as the principle device in making science policy effective must be sold to the political leaders.

Concurrently with this operation, - technical studies must be conducted which involve all the major institutions currently involved in STEI handling. Otherwise, they feel themselves threatened and will sabotage any attempts to forge a national system which will lessen their authority. The notion of making budgetary increases dependent on justification by cost-effectiveness studies, should also be established at this point.

Technical expertise in communication of information should be upgraded at this point to the highest international levels. Methods for continuous evaluation of systems to ensure they fulfil their function should also be developed.

There will of course be an overlap between each of the events I described as priority "1" and the following. It is difficult in reality, to deal with precisely time-ordered decision-points, neatly marking out one's way to a perfected system as in the classic PERT-procedure. Most of the studies adverted to above are in fact continuing efforts, running in parallel with each other, and punctuated at certain intervals by the production of reports, summarizing the progress to date.

International studies must begin, but only after internal studies are well under-way. There will then be a cross-fertilization between internal and external studies.

The legal problems of information handling must be considered, especially in relation to new problems imposed by fast and easy transmission of information. (I have a law degree myself)

An essential item for international negotiation is the determination of standards; data-coding and format; unique source designation; OCR typefaces; operating-systems; communications interfaces, etc.

Finally we must determine the roles of agencies within the nations which will participate directly or otherwise in international exchanges of information. Preferably, those information centres which are already known as centres of excellence will have prime responsibility for collecting information within their specialist field, and processing to the standard form for international interchange.

The key part of any operation is the acquisition of sufficient funds to fulfil the mission. Resources should be allocated to those competent agencies which have shown willingness to cooperate and have carried out adequate cost-effectiveness studies to justify their budgets.

The total system must then be introduced, via pilot-stages , with full redundancy to cover time-zone and stuffing problems. Strict accounting must be incorporated to ensure that all special services be amortized by the charging policy.

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